INTEGRATED ON-LINE SYSTEMS APPROACH
to
NAVY SUPPLY OPERATIONS
INPUT/OUTPUT DEVICES

Contract No. Nonr 3408(00)

Volume 3

TELEREGISTER

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Contract No. Nonr 3408(00)

Volume 3

Prepared
by

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ABSTRACT

This report is a continuation of the study of the application of on-line data processing techniques to the Navy Supply System under Contract No. NONR 3408(00).

Volumes 1 and 2, presented on July 14, 1961, included the derivation of functional, data transmission, and data storage requirements of the total Navy Supply System. In addition, these volumes included discussions of various systems and hardware configurations, and developed estimates of total systems costs. This report (Volume 3) presents the results of a study of the input/output requirements of the system. It discusses input/output systems and hardware, and develops estimates of the costs of specific input/output devices.

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PART I - GENERAL

1. INTRODUCTION

The application of integrated on-line data processing techniques to the total Navy Supply System implies a nationwide data processing and communications system where all users and management would have immediate access to the total supply situation at all times by means of a communications network linking stock points, ICP's, management control points, customer locations, and data processing centers.

Transactions are entered at random into the system through remote on-line input/output devices located at convenient user locations. Each transaction is immediately transmitted via the communication system to the processor site where, according to its type and content, files are searched, processed and updated, required action messages are generated and transmitted, and the originator is immediately notified of the action taken on his transaction. This real-time system capability has a profound influence on the procedures of data input and output and on the equipment required to implement these procedures. It is the purpose of this report to investigate these influences, and propose procedures and establish equipment requirements that take full advantages of the real-time capability of an integrated on-line data processing system.

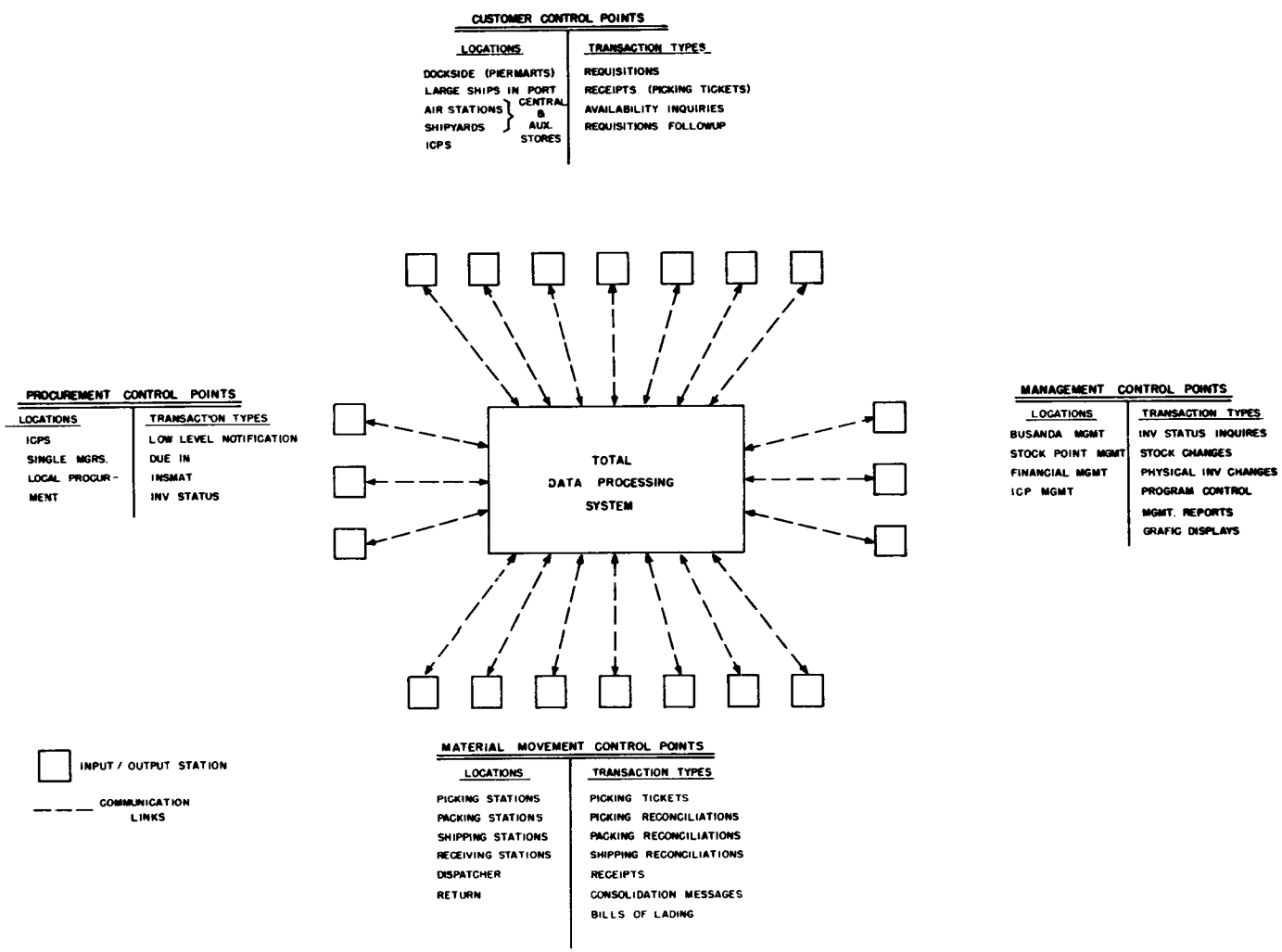
2. SCOPE OF THE STUDY

Figure 1 shows a general schematic of the four functional input/output areas of the total Navy Supply System; the location of these areas; and the type of transactions associated with these areas. For the purposes of this report, these areas have been designated as follows:

1. Customer Control Points
2. Material Movement Control Points
3. Management Control Points
4. Procurement Control Points

The scope of this study has been limited by the Scientific Officer, B. Radack, to the areas of chief concern: the Customer Control Points and Material Movement Control Points.

Figure 1: Generalized Input/Output System Schematic



3. GENERAL CONSIDERATIONS

In an integrated on-line data processing system all input/output devices are tied directly to the data processor at all times. This approach has important advantages over standard off-lines approaches to the input/output problem. These advantages are:

3.1 Input transaction message length can be reduced substantially since descriptive data and special codes may be eliminated from input messages and maintained in master files in the data processor. Since the data in these files is immediately accessible to all echelons of the total system, greater flexibility is also achieved. The data processor can create documents that can serve as future inputs to the system. This approach is particularly useful in control of material movement in warehousing operations.

3.2 In the output area, it is not necessary to generate voluminous printed reports in an on-line system since this data may be maintained at all times in its most recent form in the data processor, and any interrogation concerning this data can be answered by the data processor within seconds. This eliminates the need for many of the printed reports presently being prepared in the Navy Supply System.

3.3 Use of input devices tied directly to the data processor allows use of the data processor to check input messages for errors in data and format. If errors are detected by the processor, an error message indication is sent to the input device operator allowing immediate correction of data prior to processing the input transaction against the files of the data processor. As an example of the power of this type of accuracy control, Chart 1 shows the major item fields of a MILSTRIP customer requisition message and the checks that can be performed on these items by the central computer.

Chart 1

Checking Techniques

Field Name	Check Digit	Consistency & Comparison	High-Low Limit	Field Size
Document Number				
Service		✓		
Requisitioner	✓			✓
Date		✓	✓	✓
Serial #				✓
Document Ident.		✓		✓
FSN		✓		✓
FIIN	✓			✓
Quantity			✓	
Unit of Issue		✓		
Priority		✓		
Date Required			✓	✓
Fund Code		✓		✓
Demand Code		✓		✓
Signal Code		✓	•	✓
Supplementary Address	✓			✓
Advice Code		✓		✓
Job Number	✓			✓
Remarks		✓		

4. CHECKING TECHNIQUES

4.1 Check Digit

Check Digits of the "Mod 11" or "Casting out Nines" type can be pre-assigned to such key items as Requisitioner Number, FIIN, Supplementary Address, and Job Number. When the original document is prepared by the customer these check digits are included as part of the number. When the number is read into the central computer the program performs a mathematical manipulation on the basic number to verify the accuracy of the check digit. Most common errors such as transposition of digits, and dropping of digits, can be detected by this method. Both the original requisitioner and the input device operator are checked by this approach.

4.2 High-Low Check

The Computer Inventory Record for each item carries a high order Quantity limit for the item. The Quantity ordered is compared with this limit to determine the validity of the original order. Low limits may also be established for quantity fields of input transactions. This method of checking can also be applied to fields such as Date of Requisition and Date Required.

4.3 Consistency and Logical Checks

Such fields as Unit of Issue, Priority, Service, and Document Identifier may be checked at the central computer for consistency. For example, Unit of Issue may be compared for accuracy with the Unit of Issue field of the Inventory Record. The Document Identifier Field and Service and Priority Codes may be checked for consistency against message originating point and the Requisitioner File.

4.4 Field Size and Message Format Control

The number of characters entered for each field may be checked against pre-established fixed field standards (4 digits for dates, 5 digits for Requisitioner

Number, 9 digits for Job Number, etc.). Additionally, the Message Formats may be controlled and checked to insure that all necessary data is included in proper sequence in the input message. These controls may be either in the computer program or part of the input device controls.

4.5 Visual Display and Verification

By the use of a printer in the input/output device, the data entered by the operator may be visually verified before transmission to the central computer. Additionally, a hard copy record is produced for historical purposes and to provide a transaction audit trail.

PART II - CUSTOMER CONTROL POINTS

1. INTRODUCTION

As pointed out in BuSandA System Research Report #10, December, 1960:

"The objective of the total system is rapid predictable issues to customers, with the latter of predominant importance since predictable lead time will enable customers to adjust their operations to supply capabilities in an optimum manner."

The interface between the customer and the data-processing system is, therefore, of critical importance in the total system design.

The ideal solution to this problem is to give each customer (approximately 20,000 customers) of the Navy Supply System an input/output device tied directly to the data-processing system. With present costs of input/output devices ranging between $2,000 and $15,000 (depending upon their characteristics) the costs of this approach would be prohibitive (between 40 and 200 million dollars for input/output devices alone). Thus, a compromise solution must be found which balances the cost of input/output equipment with the required functional capabilities inherent in the objective of "rapid predictable issues."

2. SUBSYSTEM CONCEPTS AND PROCEDURES

With this in mind, we have organized the customer input/output interface around the concept of Customer Control Points. Customer Control Points would be located throughout the Navy Supply System on the basis of volume of input transactions and convenience to the ultimate user. Typically, Customer Control Points would be located at dockside at piermarts, aboard large ships in port, at auxiliary storage locations of air stations, and at Material Control Points of shipyards. Customer Control Points would be staffed by clerks trained in the manual operation of the input/output devices and supply system procedures. Thus, each customer transaction would be screened by properly trained personnel prior to entry into the system. It is estimated that trained operators can generate approximately 500 requisitions per day. On the basis of present average-day customer transac-

tion volume (125,000 transactions, FY 1960) approximately 250 manually-operated customer input/output devices would be required in the total system. On the basis of locating input/output devices at convenient customer locations and handling peak volume days, this number would be substantially increased.

Figure 2 shows the general flow of different types of customer transactions from the customer to the Customer Control Point and the Data Processing System. Chart 2 shows the message format for each type of customer transaction.

3. INQUIRY TRANSACTIONS

The Customer Inquiries of the system fall into three categories: Availability Inquiries, Requisition Followups, and Inventory Status Inquiries. These inquiries may arrive at the Customer Control Point through the mail, be hand carried, or telephoned. For each inquiry, a hard copy card is prepared showing the inquiry and the reply to the inquiry. Figure 3 shows typical transaction cards generated at the Inquiry Station. Each card is capable of recording more than one inquiry transaction. The procedure for an Availability Inquiry would be as follows:

1. A blank card is inserted in the Inquiry Device.
2. Customer designation, date material required, priority, FIIN, and quantity are entered by the machine operator.
3. Upon operation of an Availability Inquiry key, the inquiry is printed on the card and the message is transmitted via the communication link to the data processor.
4. The data processor looks up the FIIN in its files, determines the availability of the item, and immediately sends a reply message to the Inquiry Device via the communications link.
5. The reply message indicating the date material will be available is printed on the card within seconds of the original inquiry.
6. If more than one availability inquiry is made by the same customer, the inquiries and replies will be printed on the same card. (A copy of the card is given to the customer for his records.)
7. If, having determined the availability of a number of items, the customer desires to order the items, a hold can be placed on the item records in the data processor until additional requisitioning data is entered into the system.

Figure 2: Transaction Flow Chart-Customer Control Point

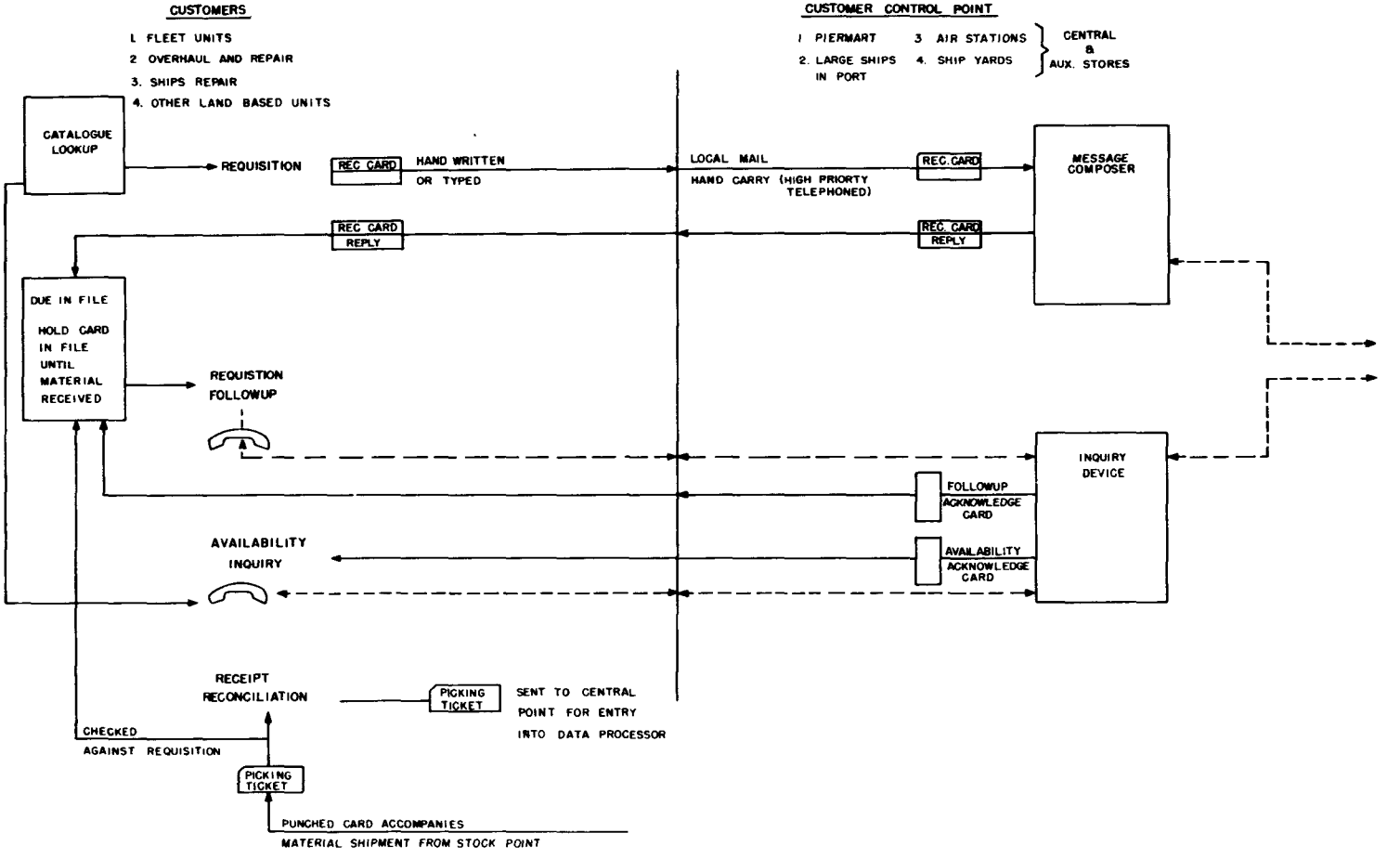


Chart 2

CUSTOMER CONTROL POINT MESSAGES

	REQUISITION LONG FORM		REQUISITION SHORT FORM		REQUISITION FOLLOWUP OR CANCEL		AVAILABILITY INQUIRY		INVENTORY STATUS INQ.	
	INPUT	REPLY	INPUT	REPLY	INPUT	REPLY	INPUT	REPLY	INPUT	REPLY
Rquisitioner #	5N	5N	5N		5N					
Date	4N	4N			4N				4N	
Serial #	4N	4N		4N	4N			4N		
FSN	4N*									
FIIN	8N*	8N	8N				8N		8N	
Quantity	5N	5N	5N				5N			
Unit of Issue	2A									
Priority	2N		2N				2N			
Date Required	4N		4N				4N			
Supplementary Add.	5N									
Job Number	9N									
Exception Codes	5N									
Delivery Date		4N		4N		4N		4N		
Delivery Method		2A								
Status						2N				
Exception Code		1N				1N				
Price		5N								
Authorization										
Remarks	60A									
Stock Point		4N		4N		4N		4N	4N	
Inventory Quantities										15
Total (Max.)	117 A/N	42 A/N	24N	12N	13N	11N	19N	12N	16N	15N

*May use Manufacturers # or Navy # in place of FSN and FIIN.

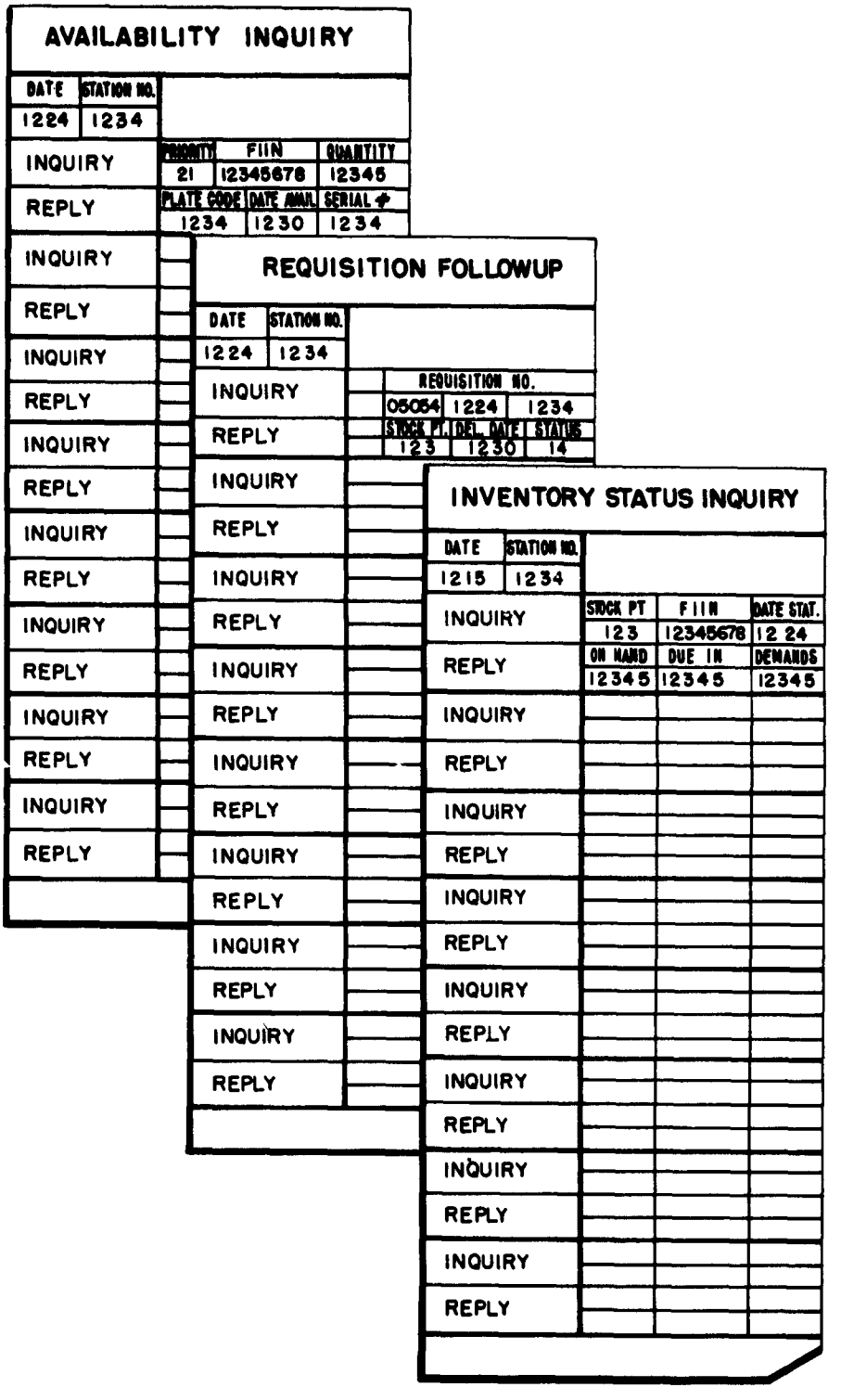


Figure 3: Typical Inquiry Transaction Cards

A similar procedure would be followed with Requisition Followup Inquiries and Inventory Status Inquiries. The data messages and printed card formats are shown in Chart 2 and Figure 3, respectively.

By the judicious location of Customer Control Points throughout the Navy Supply System and the use of telephoned inquiries, all customer requests for information can be answered within seconds of the original queries

4. REQUISITION INPUT

Analysis of the data required on requisitions indicates that a large percentage of all requests for material require only a minimum of data to properly fill the requisition. These requisitions require only requisitioner number, FIIN, priority, date required and quantity fields. All of this data is numeric only. The requisitions not falling into this category are those that require special handling because of item designation exceptions such as use of Navy Numbers, or manufacturer number or special descriptive designations, or special shipping or billing instructions. This exception data is normally alphanumeric in content. In order to minimize the total input/output equipment costs we recommend that these two types of requisitions be handled by different procedures and different input devices. Figures 4 and 5 show the card forms for the two types of requisitions which, for purposes of description, we have designated the Short Form and Long Form. The Short Form is similar to the Inquiry Form and uses the same input/output device. The Long Form is similar in format to MILSTRIP and requires an alphanumeric input device.

4.1 Short Form

In an On-Line Data Processing System the original requisition form is not used as the picking ticket in warehousing operations. In the warehousing operations, a punched card picking ticket is issued from the data processor for each item to be picked. This card moves with the material until it is received by the customer and is used for reconciliation purposes at each stage of the material movement procedure. (This procedure is described in detail in Section III of this

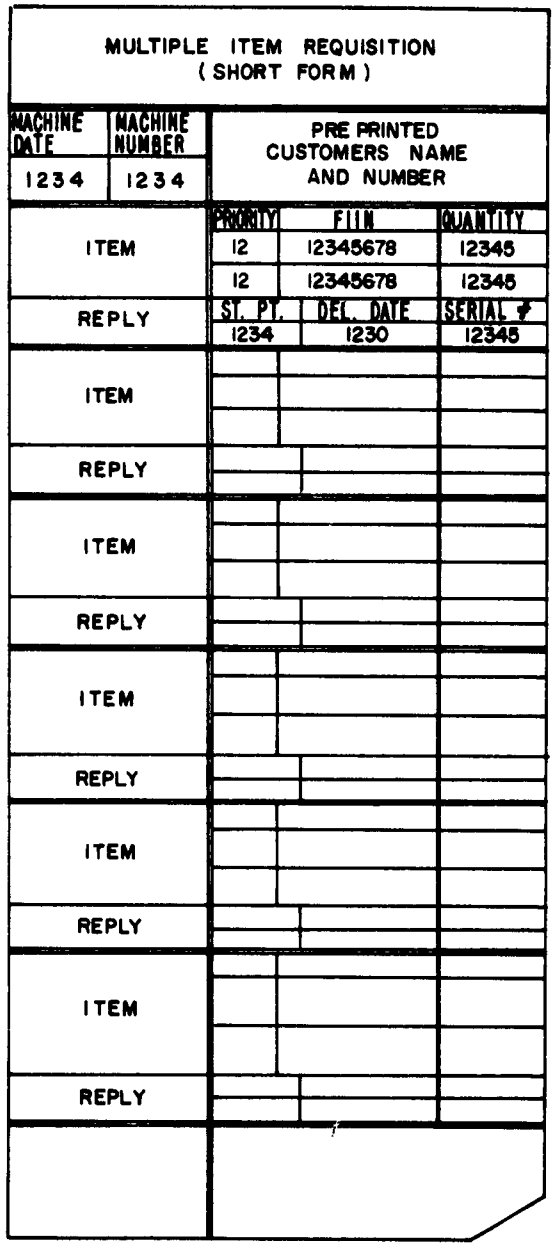


Figure 4: Requisition Card-Short Form

REQUISITIONER	DATE	SERIAL NO.	PRIORITY	DMR	REQUISITION FROM:
05054		1234			U.S.S. SHARK

CLASS & GP	FIIN	QUANTITY	UN. IS.	JOB NUMBER	SUPPLEMENTARY ADDRESS	AUTHORIZATION

REMARKS:

DO NOT SUBSTITUTE		NAVY NUMBER USED		REQUISTIONER PICKUP	NO BILLING REQ.
DO NOT OBLIGATE		MFR. NUMBER USED		SUPPLEMENTARY ADD.	SUPPLEMENTARY ADD.
EXACT QUANTITY ONLY		SPECIAL DESCRIPTION		SPECIAL DESCRIPTION	SPECIAL BILLING

REPLY: DOCUMENT #	FIIN	C	QUANTITY	DEL. DATE	METHOD	STOCK POINT LOCATION	PRICE	EXCEPTION

REQUISITION LONG FORM

(A)

REQUISITIONER	DATE	SERIAL NO.	PRIORITY	DMR	REQUISITION FROM:
05054	1224	1234	12	1230	U.S.S. SHARK

CLASS & GP	FIIN	QUANTITY	UN. IS.	JOB NUMBER	SUPPLEMENTARY ADDRESS	AUTHORIZATION
1234	12345678	12345	Ea	123456789	12345	G. Jones - 12

REMARKS: Ship + Hold at Newport until claimed

DO NOT SUBSTITUTE	X	NAVY NUMBER USED		REQUISTIONER PICKUP	NO BILLING REQ.
DO NOT OBLIGATE		MFR. NUMBER USED		SUPPLEMENTARY ADD.	SUPPLEMENTARY ADD. X
EXACT QUANTITY ONLY	X	SPECIAL DESCRIPTION		SPECIAL DESCRIPTION X	SPECIAL BILLING

REPLY: DOCUMENT #	FIIN	C	QUANTITY	DEL. DATE	METHOD	STOCK POINT LOCATION	PRICE	EXCEPTION

CUSTOMER OPERATION

(B)

REQUISITIONER	DATE	SERIAL NO.	PRIORITY	DMR	REQUISITION FROM:
05054	1224	1234	12	1230	U.S.S. SHARK
05054	1224	1234	12	1230	

CLASS & GP	FIIN	QUANTITY	UN. IS.	JOB NUMBER	SUPPLEMENTARY ADDRESS	AUTHORIZATION
1234	12345678	12345	Ea.	123456789	12345	G. Jones - 12
1234	12345678	12345	Ea.	123456789	12345	12

REMARKS: Ship + Hold at Newport until claimed
Ship and Hold at Newport until claimed

DO NOT SUBSTITUTE	X X	NAVY NUMBER USED		REQUISTIONER PICKUP	NO BILLING REQ.
DO NOT OBLIGATE		MFR. NUMBER USED		SUPPLEMENTARY ADD.	SUPPLEMENTARY ADD. X X
EXACT QUANTITY ONLY	X X	SPECIAL DESCRIPTION		SPECIAL DESCRIPTION X X	SPECIAL BILLING

REPLY: DOCUMENT #	FIIN	C	QUANTITY	DEL. DATE	METHOD	STOCK POINT LOCATION	PRICE	EXCEPTION
05454 1224 1234	12345678	A	12345	1230	PP	Norfolk	12.54	

MESSAGE COMPOSER OPERATION

(C)

Figure 5: Requisition Card-Long Form

report.) The original requisition form is retained at the Customer Control Point or returned to the requisitioner for historical record keeping purposes. The data on the requisition form is routed through the communications system to the data processor. Because of this approach, the concept of multiple item requisitions appears to be feasible and also desirable in the On-Line Data Processing System.

Figure 4 shows an example of a Short Form Multiple Item Requisition. It is proposed that a form similar to this be used for requisitions that do not require special descriptive data for item identification, shipping, or billing. The requisitioner would enter on the requisition the priority, DMR, FIIN, and quantity for each item. The requisition would be sent, hand carried, or telephoned to the nearest Customer Control Point. At the Customer Control Point the Inquiry Device operator would insert the card in the machine and enter in the requisitioner, priority, DMR, FIIN and quantity information. This input message would be printed on the card and transmitted via the communications line to the data processor site. A reply message would be sent from the data processor to the inquiry device indicating the stock point supplying material and the predicted delivery date. A serial number would be assigned the item by the data processor. This reply message would be printed on the reply line of the Short Form. Additional items would be entered on the following lines of the Short Form.

4.2 Long Form

The Long Form would be used primarily for requisitions requiring substantially more input data and requiring exception action on the part of the Supply System. The requisitioner fills in data in handwritten or typed form as shown in Figure 5b. The main differences between this Long Form and the MILSTRIP Form lies in the method of coding exception actions such as Fund, Demand, and Advice codes, and in the inclusion of a Remarks field in the Long Form. MILSTRIP imposes the burden of coding exceptions upon the requisitioner, requiring that he look up the proper codes for each exception. In the Long Form shown, each type of exception pertinent to the Navy Supply System is listed on the form and the requisitioner merely checks the exception actions applicable to the particular transaction. The Requisition is sent or hand carried to the Customer Control Point where the on-line input machine operator enters the data as shown

in Figure 5c. The data is printed as entered on the line below the requisitioner data, allowing a visual check of all data prior to transmission to the data processor. Special keys are included on the keyboard of the input device for entering of the exception actions required. The input machine translates these key operations to codes for transmission to the data processor. When the message has been composed by the machine operator, it is transmitted over the communications line to the data processor. A reply message consisting of FIIN, quantity, predicted delivery date and method, etc., is sent from the data processor to the input device and printed on the last line of the Long Form (Figure 5c). Copies of the Long Form may be retained at the Customer Control Point and returned to the requisitioner for historical purposes.

5. CUSTOMER RECEIPT RECONCILIATIONS

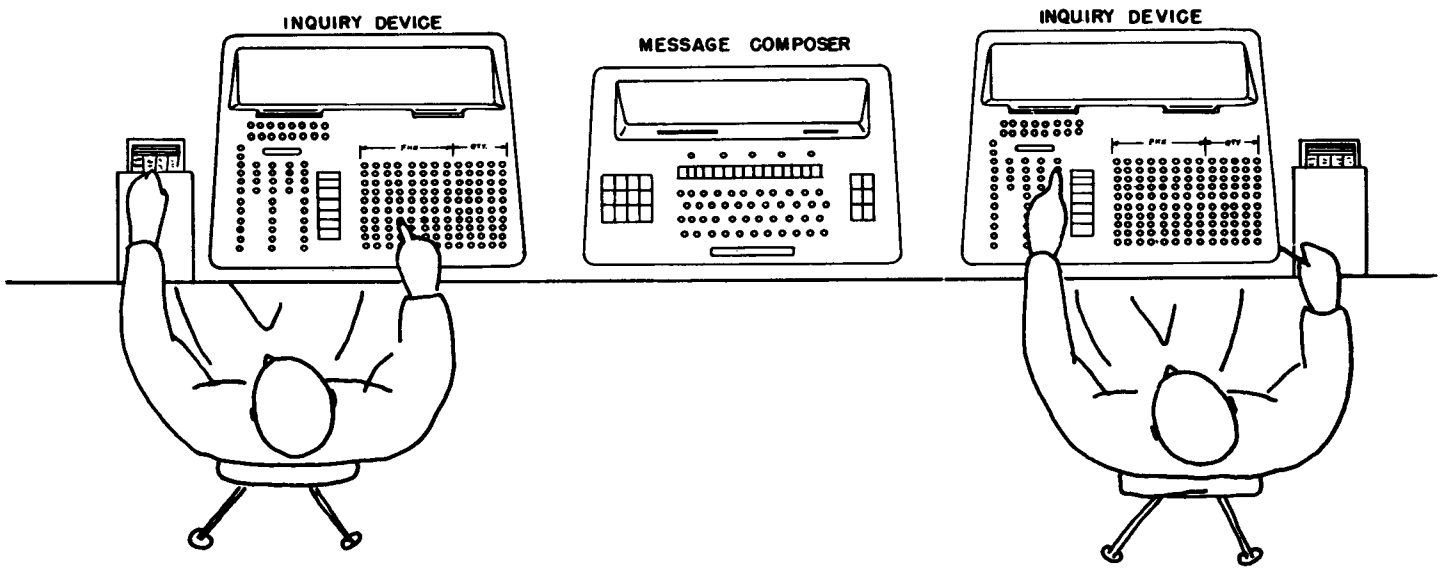
As pointed out earlier, a punched card picking ticket accompanies the material from the time it is picked until it received by the customer. It is proposed that this picking ticket be used as the final reconciliation message to the Data Processing System to close the loop of requisition, issue, shipping and customer receipt.

In this approach, after checking the material against his copy of the original requisition, the customer would send the punched picking ticket to the nearest Customer Control Point where it would be entered into the Data Processing System where the In Process File would be cleared of the original transaction.

6. EQUIPMENT CHARACTERISTICS

In the foregoing sections of this report, the system and procedures of a Customer Control Point were discussed. Two basically different types of input/output equipment were mentioned. It is the purpose of this section to describe in more detail the functional requirements of these equipments. It is visualized that there will be substantially more of the numeric Inquiry Devices in the system than alphanumeric Message Composers. Figure 6 shows an artist's rendering of a typical Customer Control Point installation, with two Inquiry Devices and one Message Composer.

Figure 6: Typical Customer Control Point Installation



6.1 Inquiry Device (Figure 7)

The function of this device is to enter inquiries by customers concerning item availability, requisition followup or cancel, and inventory item status. Additionally, the device will be used for entry of Short Form requisitions. The major components of the device are:

1. Full Bank Numeric Keyboard
2. Numeric Card Printer
3. Card or Plate Reader

6.1.1 Full Bank Keyboard

The keyboard of this device will be of the full bank variety, allowing ease of data entry and keyboard storage of data. The keyboard will consist of the following types of keys: Transaction Type keys for Status Inquiry, Availability Inquiry, Requisition Followup, Requisition Cancel, and Short Form Requisition; Priority keys; Date Material Required keys; and 13 rows of numeric keys for entry of FIIN and quantity, or requisition number.

6.1.2 Numeric Printer

The numeric printer will be capable of printing data entered from the keyboard on input (approximately 15 digits) and all data required on replies (approximately 15 digits). Data will be printed on cards in a format similar to that shown in Figures 3 and 4. A semi-fixed print unit will also be included for date and machine number.

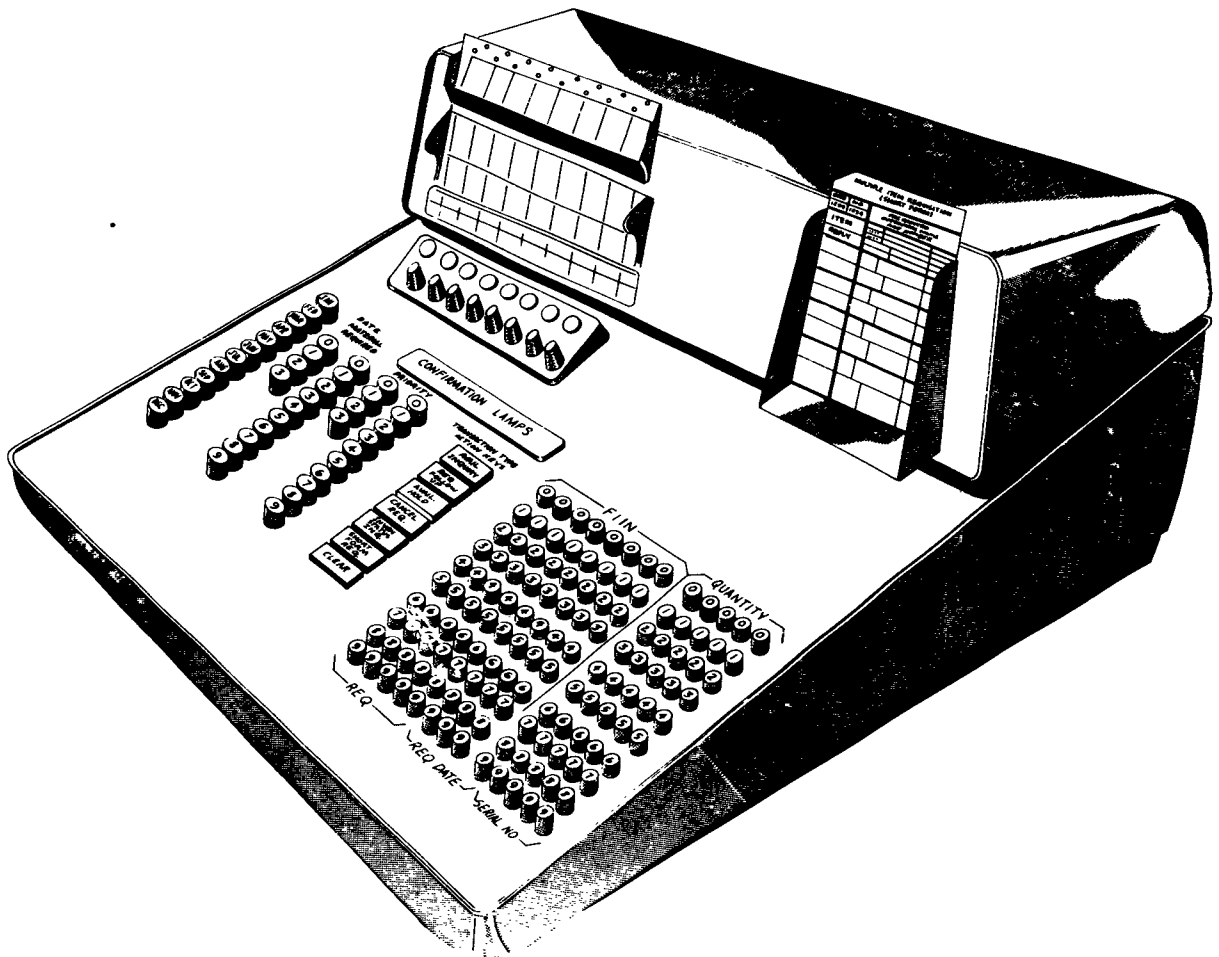
6.1.3 Card or Plate Reader

A means will be provided for automatic entry of data concerning requisitioner number and/or stock point location. Figure 8 shows a typical plate allowing selection of up to 64 different customer numbers or stock location from a single plate. Each edge of the plate has two rows with eight customer numbers per row. Using both front and back of the plate allows 64 selections per plate.

6.1.4 Estimated Price

On the basis of 500 to 1000 Inquiry Devices in the total system, it is estimated that each device will cost approximately $3,500. Using a 36 month amortization time, this would result in a rental of $97 per month per device. These estimates do not include the necessary equipment to interface the Inquiry Device with the communications link, since this equipment is dependent upon the data processing system chosen and the total system and communication configuration.

Figure 7: Inquiry Device



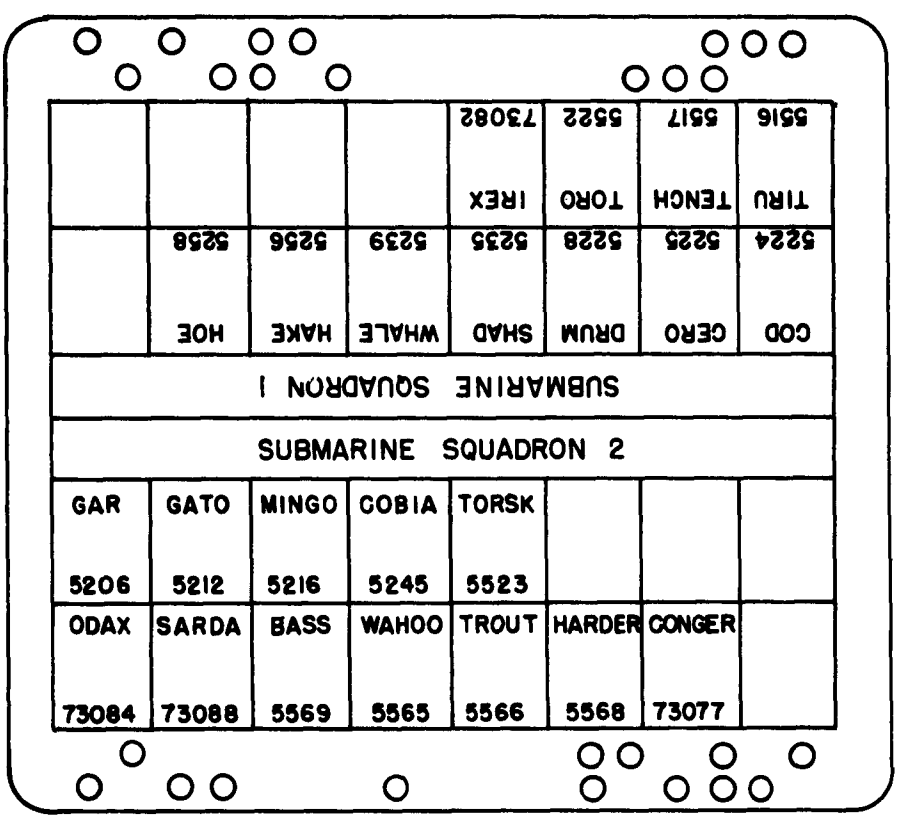


Figure 8: Typical Inquiry Device Input Plate

6.2 Message Composer (Figure 9)

The function of this device is to enter Long Form requisitions and Receipt Reconciliation messages into the Data Processing System. The major components of the device are:

1. Alphanumeric Printer
2. Alphanumeric Keyboard
3. Format Control Keys
4. Operation Exception Keys
5. Transaction and Control Keys
6. IBM Card Reader

6.2.1 Alphanumeric Printer

The Alphanumeric Printer unit will be capable of printing approximately 72 characters/line (10/inch) on a standard-size IBM card. The line of printing will be visible to the operator in addition to previously printed lines. The device will accept a manually inserted card and automatically eject the card when the transaction is complete. In addition, a carbon copy transaction register will be printed.

6.2.2 Alphanumeric Keyboard

The Alphanumeric Keyboard is essentially a standard typewriter keyboard. Data is entered from the keyboard to a communications buffer and to the alphanumeric printer.

6.2.3 Format Control Keys and Lamps

The Format Control lamps operate in conjunction with the Transaction keys and the Operation Exception keys. The lamps light in sequence on the basis of a pre-wired program selected by the Transaction keys and modified by the Operation Exception keys. After each field is entered, the Format Control key that is lighted is depressed, causing the next Format Control key to be illuminated.

6.2.4 Operation Exception Keys

These keys are used to allow the operator to easily indicate decisions concerning the transactions entered into the device. These keys, when operated, will insert proper codes into the communications buffer, print X's in the proper location on the card, and control the data entry format.

6.2.5 Transaction and Control Keys

Transaction keys for Long Format requisitions and Receipt Reconciliations are used to control the program format. Depending upon the location of the Message Composer, other types of transaction keys may also be included. Additional keys for clearing messages from the buffer, or printing from the buffer are also included.

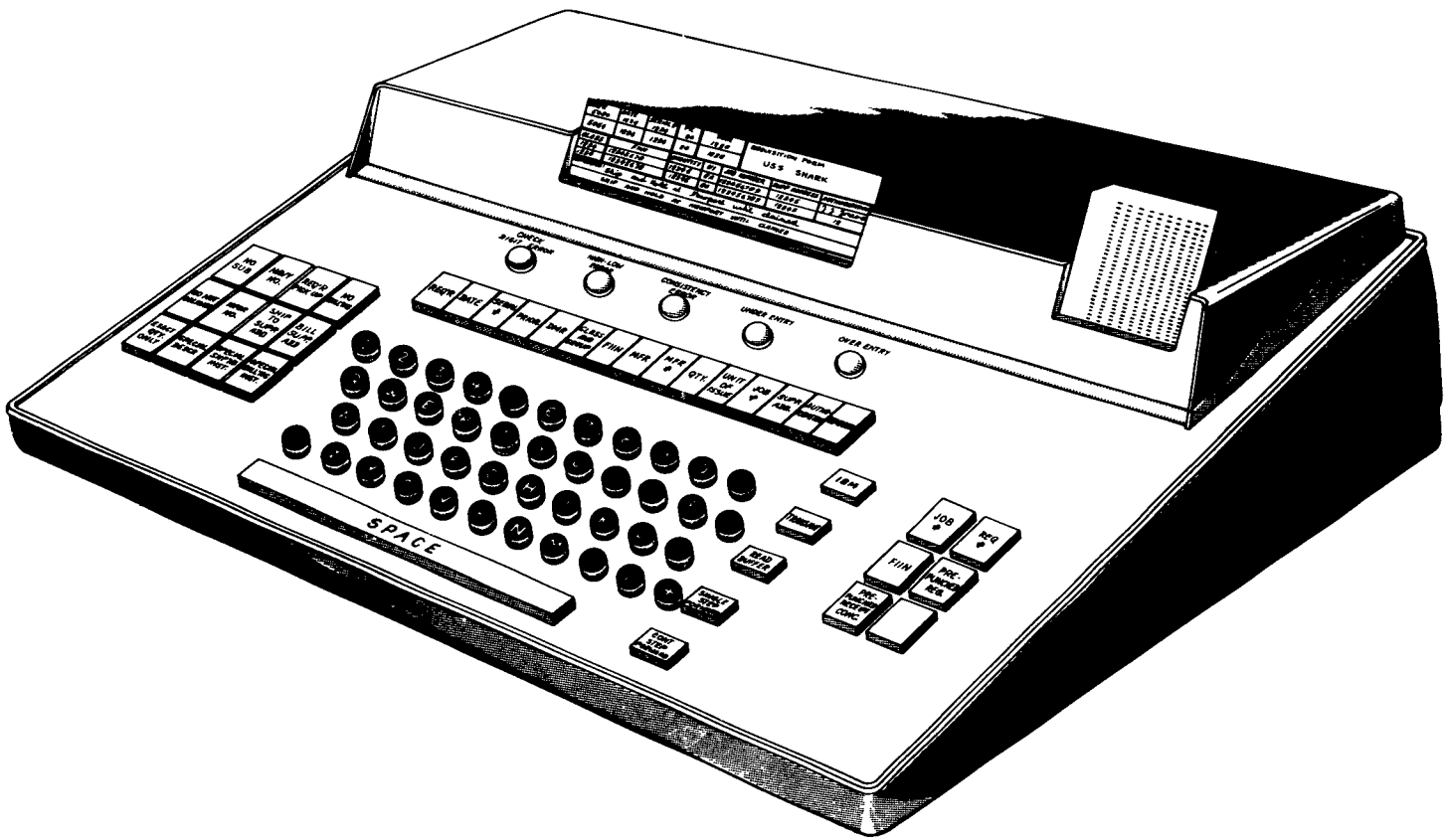
6.2.6 IBM Card Reader

The IBM Card Reader unit will be capable of accepting manually-inserted cards and reading data in standard alphanumeric IBM code. Data will be entered from the card to the communications buffer and printer under program control. The card will automatically be ejected after reading. The Card Reader will be modular in construction so that the Message Composer may be installed with or without the reader, depending upon the location of the device and the detailed application.

6.2.7 Estimated Price

On the basis of 200 - 400 Message Composers in the total system, it is estimated that each device will cost between $10,000 and $12,000. Using a 36-month amortization time, this would result in a rental of $280 to $330 per month per device. These estimates do not include the necessary equipment to interface the Message Composer with the communications link, since this equipment is dependent upon the data processing system chosen and the total system and communication configuration.

Figure 9: Message Composer



PART III - MATERIAL MOVEMENT CONTROL POINTS

1. INTRODUCTION

This section describes the warehousing procedures in a total supply system. Warehouse functions include receiving, storage (Receipt Cycle)-picking, packing and shipping (Issue Cycle) (Figures 10 to 13). Whereas the described procedures relate to a completely on-line system, the functional concepts could readily apply in areas where existing equipment is not compatible with on-line transaction processing.

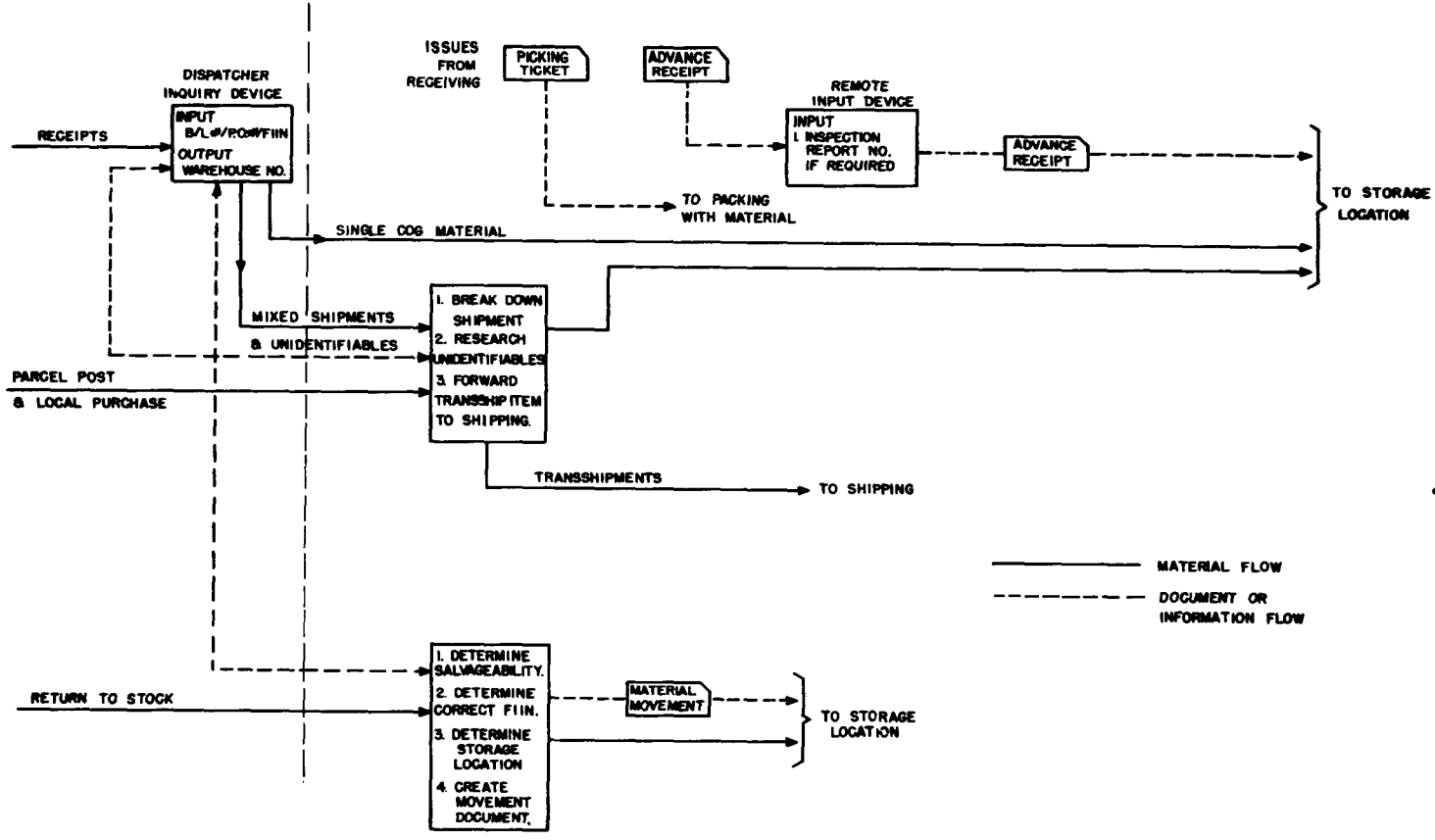
It is proposed that step by step control be maintained over all transactions processing through the warehouse. This will be accomplished by a series of reconciliations - one after each procedural step.

To simplify the reconciliation task, pre-punched EAM cards are pre-positioned in various areas. These cards, which also contain transaction instructions, are input to the processor, via remote on-line input devices, as the material proceeds through the area, thereby effecting reconciliation. Where practicable, the cards are designed for multiple use and are forwarded with material for subsequent re-entry.

The reconciliation concept is primal in real-time operation in the warehouse. It achieves tight in-process control where the transaction procedure involves a large measure of human intervention.

To reduce equipment cost, all supply points will contain a central Material Movement Control Center. This center will contain card transceivers and sorting equipment, and will serve as a distribution point for all messages issued by the data processor relating to warehouse activities. Formats of messages pertinent to warehousing functions are shown in Chart 3. Cards will be hand delivered to the individual warehouses on a scheduled basis, except for high priority messages, which will be delivered immediately.

Figure 10: Transaction Flow Chart-Receiving



RECEIPT PROCESS

Figure 11: Transaction Flow Chart-Storage-Picking

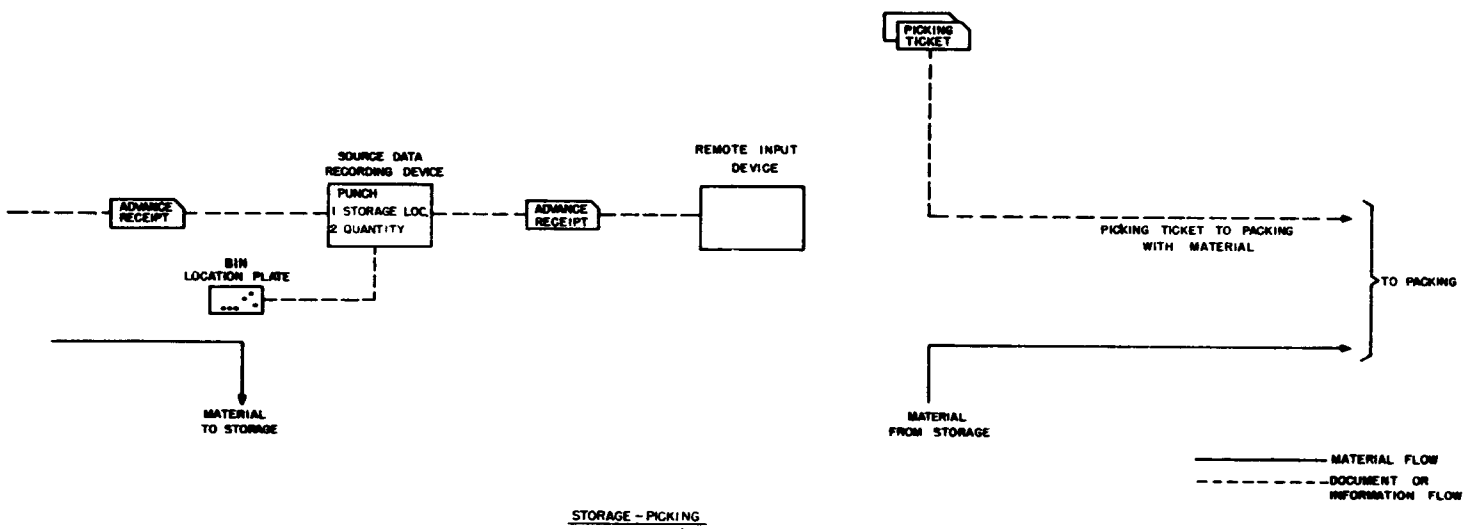
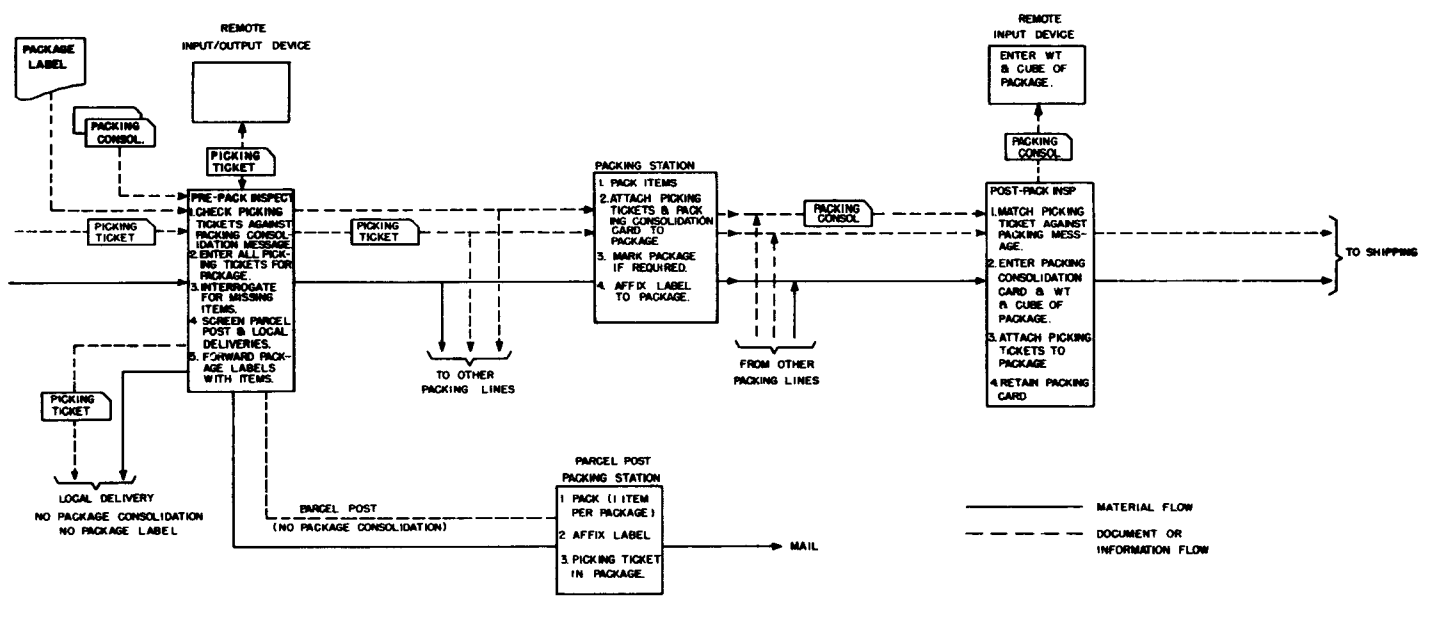


Figure 12: Transaction Flow Chart-Packing



PACKING

Figure 13: Transaction Flow Chart-Shipping

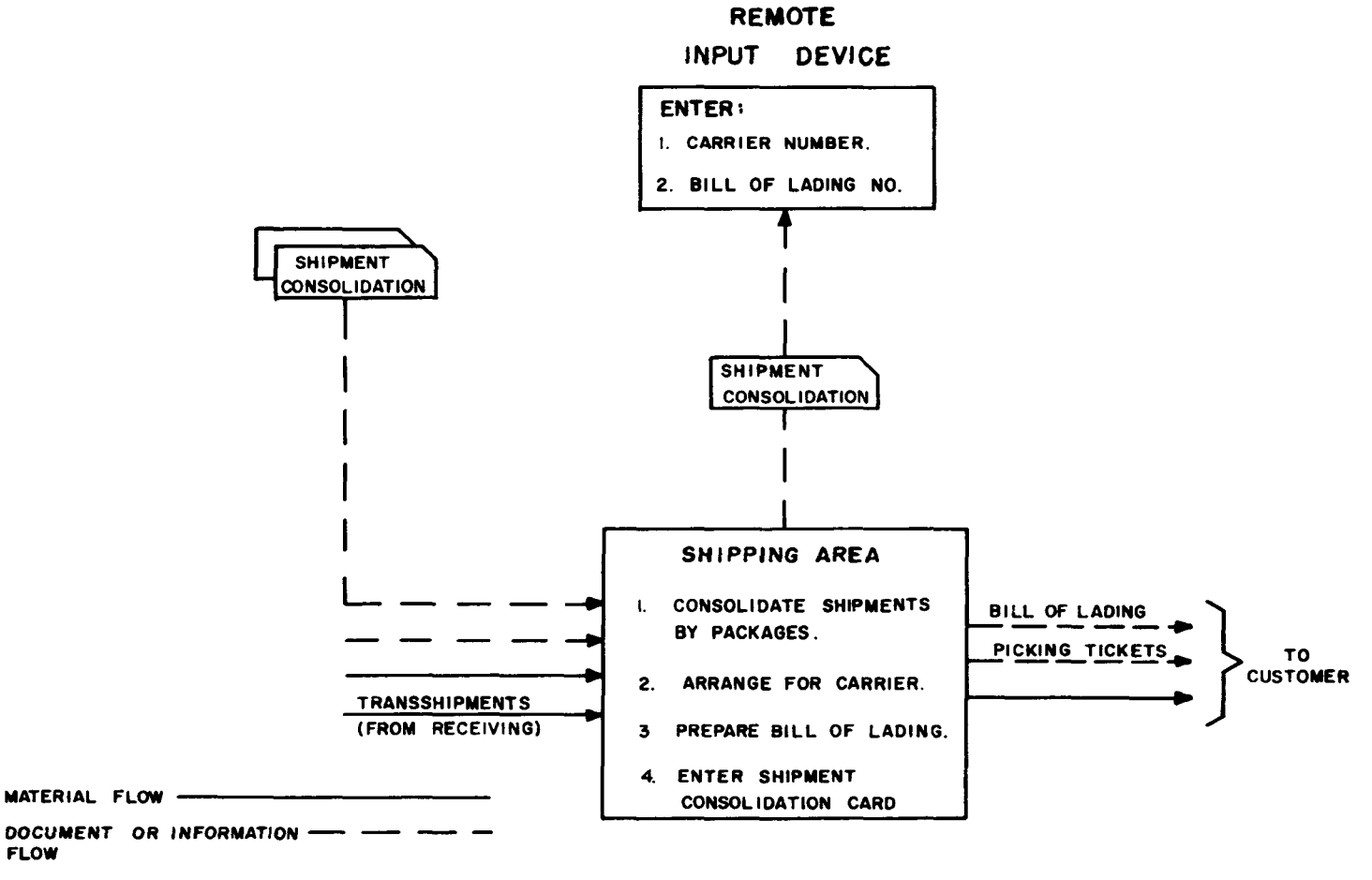


Chart 3

MATERIAL MOVEMENT CONTROL POINT MESSAGES

FIELD NAME	MAX. FIELD SIZE	RECEIPT DISPATCH		RECEIVING			ISSUES		PACKING			SHIPPING	
		INQUIRY	REPLY	ADVANCE RECEIPT	RECEIVING RECONCIL.	WHSE RECON.	PICKING TICKET	PICKING RECON.	PKG. CONSOL.	PKG. RECON.	PKG. LABEL	SHIPMENT CONSOL.	SHIPMENT RECONCIL.
Document Identifier	3A/N			✓	✓	✓	✓	✓	✓	✓		✓	✓
FIIN	8 N	✓ [4]		✓	✓	✓	✓						
Unit of Issue	2 A			✓		✓	✓						
Quantity	6 N			✓		✓	✓						
Storage Loc'n	5 N		✓ [1]	✓		✓	✓						
Requisitioner (Customer Acc't No.)	5 N						✓	✓ [3]	✓			✓	
Date	4 N						✓	✓ [3]					
Serial No.	5 N						✓	✓ [3]					
Supplementary Address	5 N						✓						
Priority	2A/N						✓						
Package No.	7 N	✓ [4]		✓			✓	✓	✓	✓	✓		
Advice	2A/N			✓			✓		✓				
Bill of Lading No.	8 N	✓ [4]		✓	✓								✓
Purchase Order No.	12N	✓ [4]		✓ [**]	✓ [**]								
Shipment Consolidation No.	9 N		✓ [2]								✓	✓	✓
Carrier No.	4 N												✓
Number of Items in Package	2 N								✓				
Inspection Report #	7 N				✓								
Quantity Received	6 N					✓							
Package Weight	4 N									✓			
Package Cube	3 N									✓			
NMFC	5 N										✓		
MARKS	20A/N										✓		
Consignee Name & Address	30A/N										✓		
No. of Packages in Shipment	2 N											✓	
Kind of Packages	1 A											✓	
Description	5 N										✓	✓	
Appropriation Chg.	5 N											✓	
Shipment Weight	5 N											✓	
Shipment Cube	4 N											✓	
Consignee	5 N											✓	
Destination	5 N											✓	
TOTALS		12	9	45	30	30	54	24	19	17	76	49	24

1. Reply to Input of FIIN or B/L # or P/O #.
2. Reply to Input of Package Number.
3. For each Item in Package. Average 2.5 Items/Package
4. One Item per Message.

2. RECEIVING CYCLE

To facilitate material receipts, all incoming material will be cleared through a central dispatch point. This point should be established in or adjacent to a large warehouse which could serve as a clearing house for mixed shipments and returns to stock in addition to its normal warehouse activities.

The main function of the receipt dispatcher will be to route all incoming material to correct storage or processing locations minimizing subsequent rehauling and misplaced material. The dispatcher will be provided with an inquiry device through which he may interrogate the data processor files for correct receiving location. This device contains a full numeric keyboard, header keys to identify the entry, and a printer. A complete description of the unit is given in the section on equipment characteristics at the end of this section.

All trucks arriving on the base would proceed to the dispatcher and present appropriate documents. For shipments originating at another government installation, this document will be either a bill of lading or invoice, and for receipts from vendors the document will be an invoice. In any case, shipments shall be identified by one of the following:

1. Government B/L Number (10 characters)
2. Government Purchase Order Number (12 characters)
3. FIIN (8 characters)

The dispatcher will insert a blank card in the printer, key in one of these designators, and receive a printed reply giving warehouse location. The card will be given to the trucker who will proceed to the specified warehouse.

In single warehouse shipments, the trucker will be directed to the appropriate warehouse. Mixed shipments, however, will be unloaded in an adjacent area for breakdown and distribution. Personnel in this area will interrogate processor locator files through the dispatcher inquiry device.

Parcel post and mixed local procurement shipments will also be unloaded in the mixed shipment unloading area. The parcel post shipping label will indicate

a FIIN as a guide to storage location. Locally procured material will be identified by a FIIN, which will be indicated on the accompanying invoice. Other receiving points, such as railhead and dockside facilities, will contact the dispatcher by telephone for routing instructions.

Unidentifiable material will be directed to the mixed shipment unloading area where a technical search and disposition will be made. Personnel in this area will interrogate processor material locator files through the dispatcher inquiry device.

Receipts for transshipment will be broken out in the mixed shipment unloading area. Processor files will be interrogated by entering the package number through the inquiry set. The reply will give a new shipment consolidation number which will be marked on the package. The package will then be moved directly to shipping for forwarding.

Returns to stock will be unloaded in a special processing area. Here material will be identified and for each salvageable item, a punch card Material Movement Card (Figure 14) will be prepared, containing FIIN, storage location, quantity and customer account number. This card will serve the same purpose as the Advance Receipt Card described in the next paragraph. Returns will then be sent to appropriate warehouses for storage.

At each receiving warehouse, a file of Advance Receipt Cards (Figure 15) will be maintained. These cards will be issued by the processor in advance of expected date of material receipt and distributed to the receiving departments. The Advance Receipt Card will contain a bill of lading or purchase order number and a FIIN for purposes of shipment identification.

When material arrives, the advance receipt card will be matched against the bill of lading or purchase order number and FIIN on the shipping document. The Advance Receipt Card will then be entered into an on-line remote-input device completing receipt acknowledgement. These remote input devices are described in the section on Equipment Characteristics.

Figure 14: **Material Movement Card**

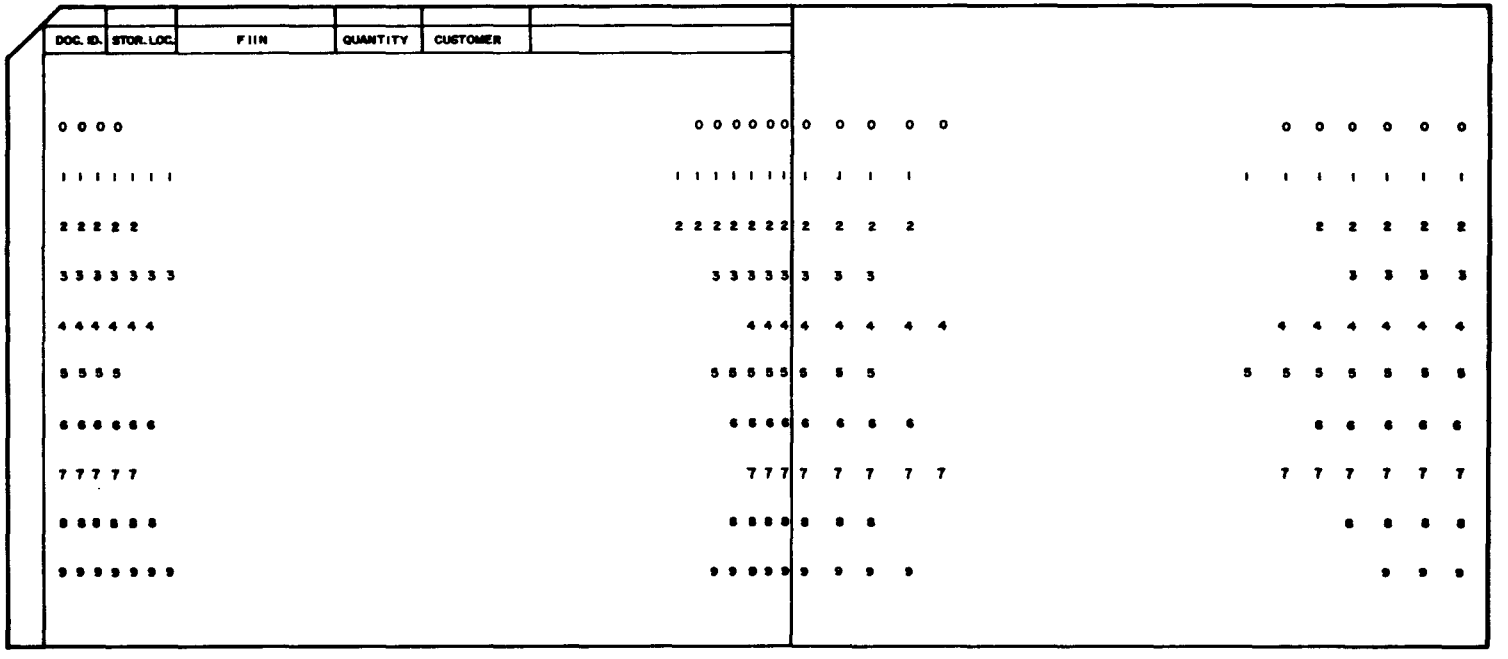
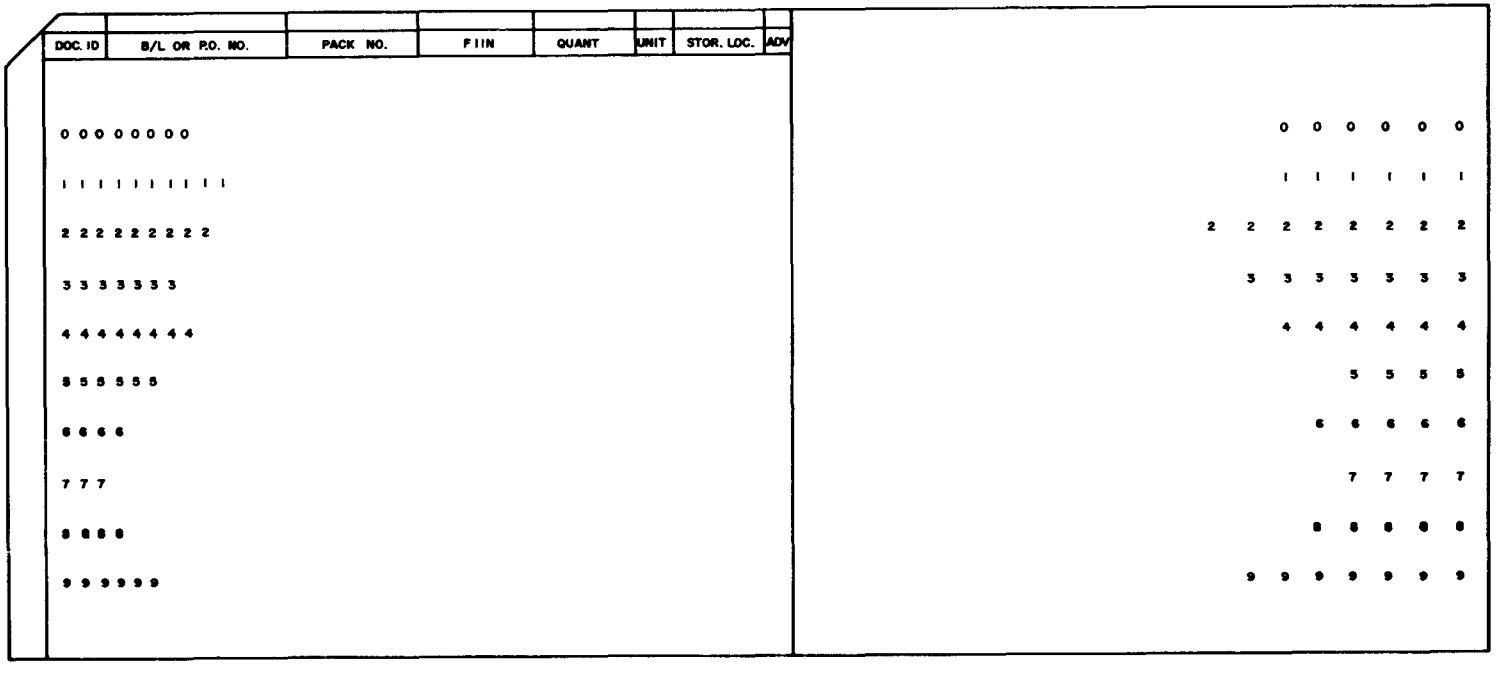


Figure 15: Advance Receipt Card



A special flagging symbol in the advice field of the Advance Receipt Card will denote receipt inspection requirement. In such instances, the advance receipt reconciliation will include an inspection report number which will be manually input.

If material is to be issued from receiving, the Advance Receipt Card advice field will again contain a special flagging symbol. In these cases, a picking ticket will have been pre-positioned in receiving with its advice field denoting the issue to be made from receiving. In such instances, material and picking tickets will be sent directly to the packing area. Receipt reconciliation will be made in the normal way.

3. STORAGE OF MATERIAL

All material entering the storage area will be accompanied by an EAM card containing FIIN, quantity and storage location. Material entering from receiving will have this information provided on the Advance Receipt Card, and returns to stock will provide this information on the Material Movement Card. Both cards are designed for use with a portable source-data-recording device, which records fixed information from a plastic or metal plate on an EAM card. A keyboard permits the inclusion of variable data at the same time. For portability, the recording devices will be mounted on carts, which will be used to carry material to and from storage.

This type of device will be used in the storage area for accurately recording storage location and stored quantity for incoming material. Individual plates will be located at each storage bin and secured in a manner that will prevent removal or misplacement.

A sample plate is shown in Figure 16. It contains storage location, FIIN, and item description in embossed form, and the storage location in code. The warehouseman may thus verify incoming material against the plate description.

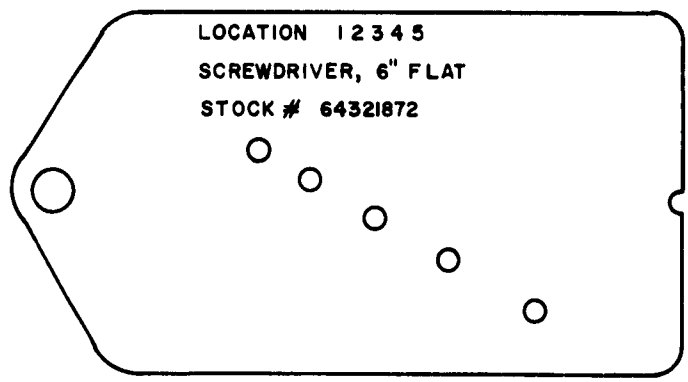


Figure 16: Bin Location Plate

After storing an item in the specified location and counting, the warehouseman will insert the location plate and either the Advance Receipt Card or Material Movement Card in the source data recorder, key in the quantity actually received, and operate the actuating arm. The punched card will then be placed in an on-line device, completing receipt reconciliation.

Processor inventory records will be adjusted at this time. The transaction will also be recorded on magnetic tape for off-line updating of due-in files and accounting records.

4. ISSUING CYCLE

Material issues will be initiated by the Picking Ticket (Figure 17). Picking Tickets for low-priority issues will be prepared by the processor during off-peak hours. For high-priority requests, the tickets will be prepared immediately. After picking, material and picking tickets will be forwarded to the packing area.

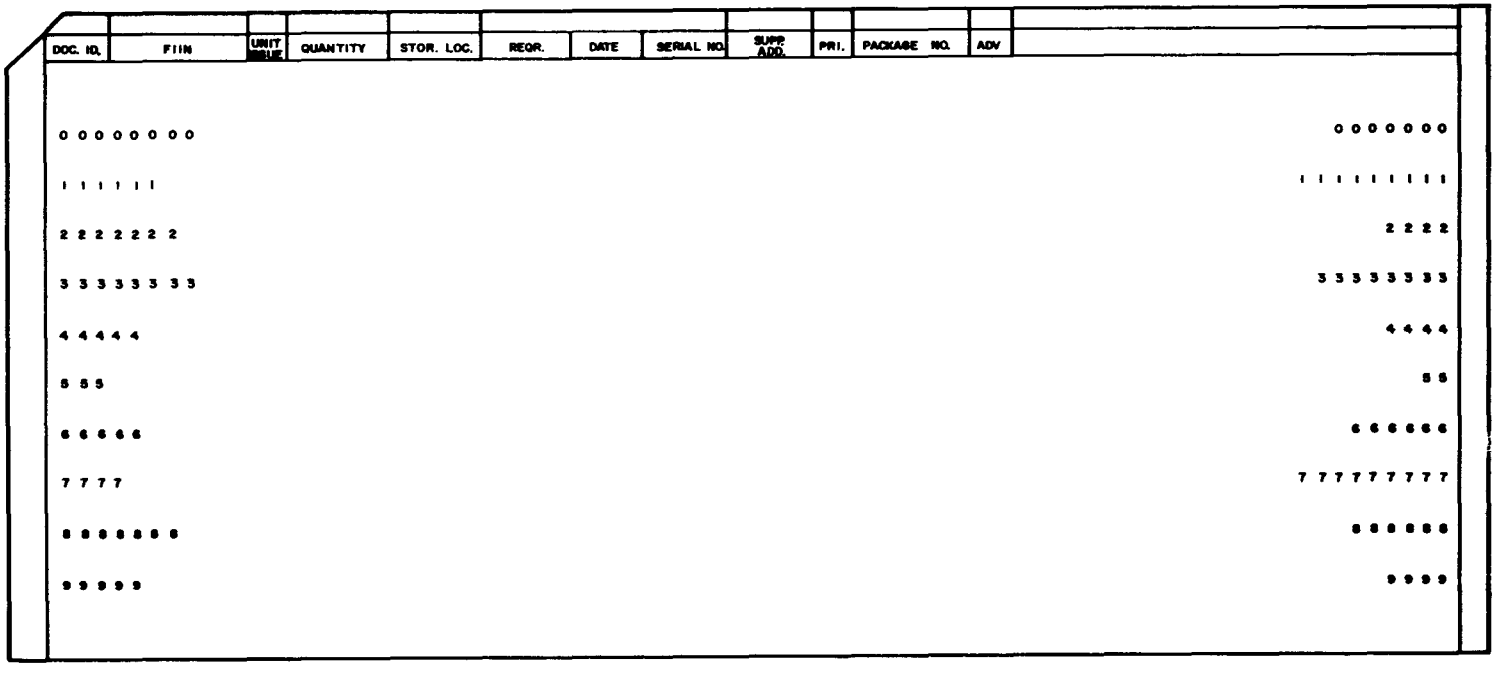
4.1 Packing

In packing, material will be sorted and packed for shipment and mailing. Material for local delivery will be culled and sent to a local delivery point.

Items for shipment to common destinations will be consolidated in single packages. Such consolidations are scheduled by the processor, and will be specified in a Package Consolidation Card (Figure 18). These cards will be prepared in advance and distributed from the Material Movement Control Center. They will be temporarily filed at the pre-pack stations (See Figure 12). No consolidation is made in parcel post and local delivery shipments.

Consolidation will be by package number. The package consolidation card will contain a package number and the number of items that make up the package. This package number will also be indicated on each item picking ticket.

Figure 17: Picking Ticket



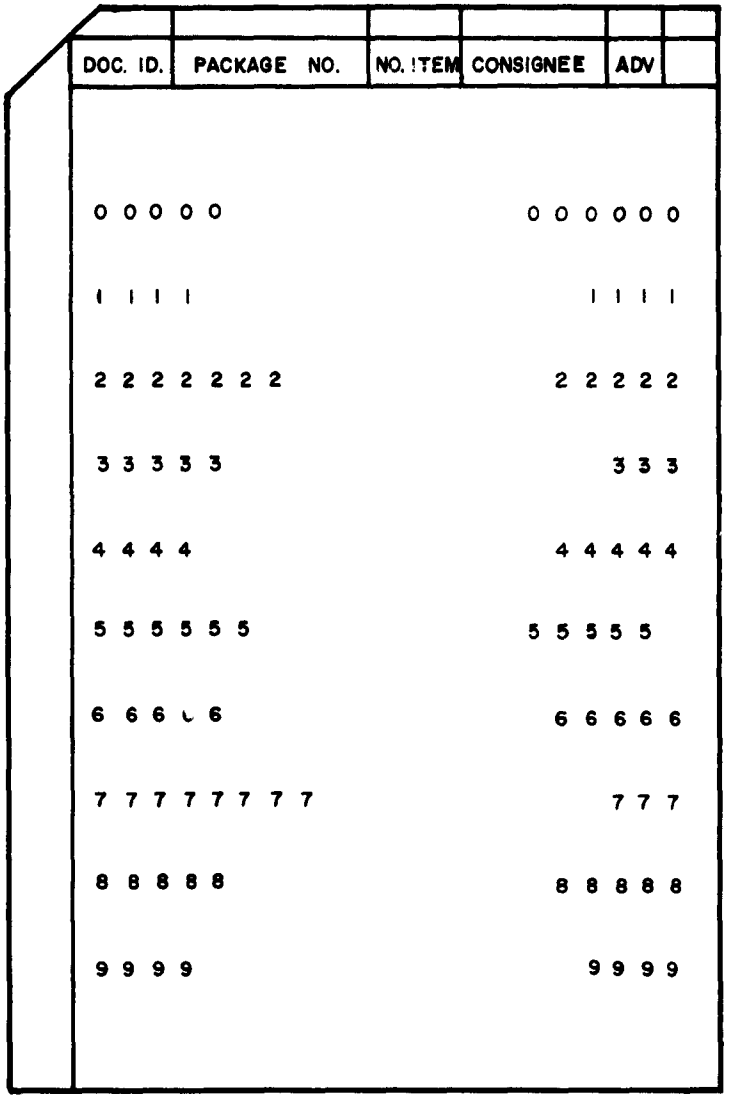


Figure 18: Package Consolidation Card

All picked items will be routed to the pre-pack station. Here the picking tickets will be entered into an on-line remote-input device for reconciliation. The tickets will then be replaced with the material.

Material for local delivery will be routed to a local delivery point after reconciliation.

Items to be shipped via parcel post will be identified by a "PP" designator in the package number field of the picking ticket. These items are mailed one item to a package. After entering the picking ticket in the card reader, a package label will be typed by output typewriter under processor control. In parcel post shipments, the label, in addition to addressee information, will contain the item FIIN for subsequent receipt identification purposes. The label will then be forwarded with material and picking ticket to a packing-mailing section for transmittal.

Items for consolidation will be accumulated in consolidation lines at the pre-pack location. Upon completion, each item picking ticket will be entered in the card reader with the package consolidation card pertaining to the package.

A package label will then be typed out, and forwarded with material and picking tickets to a packing station. The package label for carrier shipments will indicate a shipment consolidation number for shipping department use. The label will also contain any special markings to be shown on the package.

At the packing station, the material will be packed and the label affixed to the package. Picking tickets and package consolidation card will be attached to the package in a suitable envelope. Any special package marks as specified in the package label will be made by the packer.

Packages will then move to a post-pack station where the package consolidation card will be removed, the package weighed and its cubage determined. (The cubage could be easily derived through the adoption of standard carton sizes, each identified by a printed number.) The post-pack operator will enter the package consolidation card into a card reader and key in the package weight and volume. This will constitute packing reconciliation. The parcel will then move to the shipping section.

4.2 Shipping

In shipping, packages will be accumulated for bulk shipment. Shipments will be planned by the processor which will issue Shipment Consolidation Cards (Figure 19) containing instructions for consolidation and shipping. These cards will be issued in advance, and distributed from the Material Movement Control Center.

Shipment Consolidation Cards contain the following information:

1. Shipment Consolidation Number
2. Number of Packages
3. Kind
4. Consignee Code
5. Destination Code
6. Appropriation Charge
7. NMFC
8. Total Weight
9. Total Volume

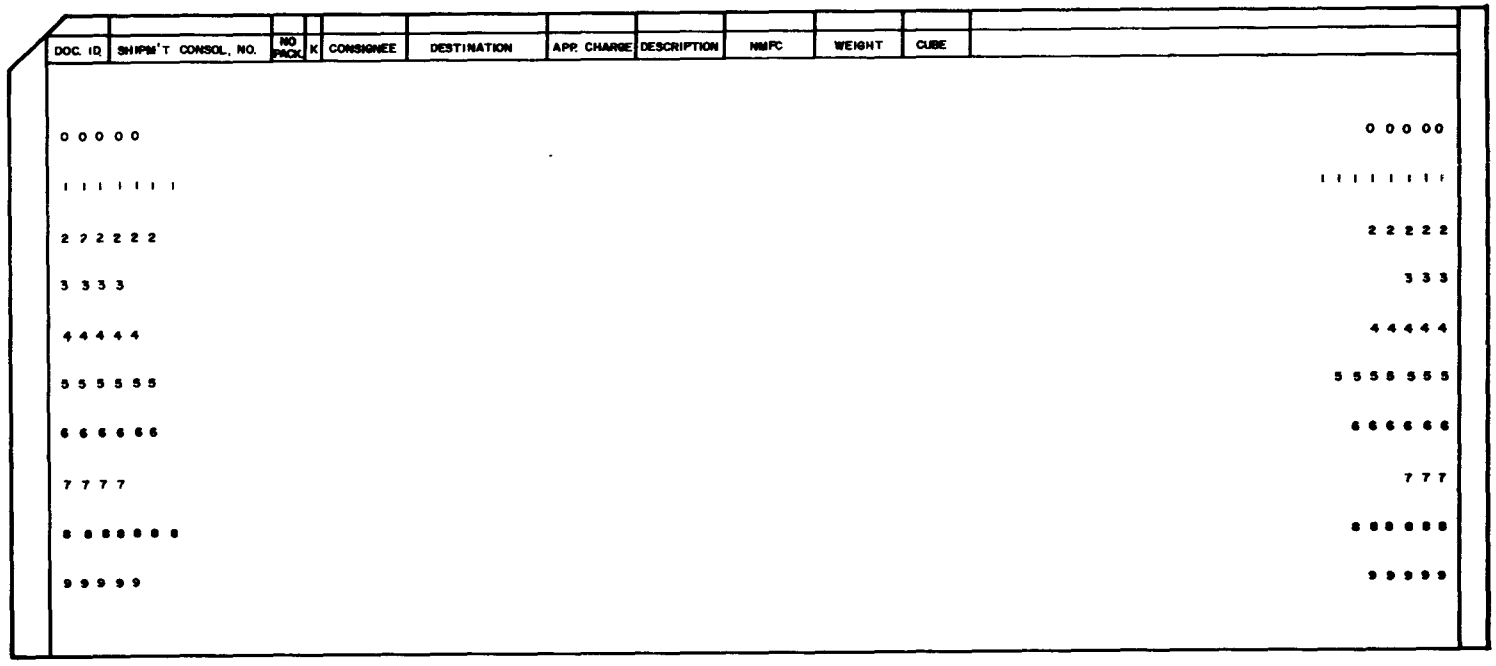
When the cards are received in Shipping, a bill of lading will be partially prepared for each shipment. Shipping personnel will be supplied with tables containing complete address and classification information for coded items in the consolidation message. In making carrier arrangements, the consolidation card will be referred to in order to take greater advantage of carload and truckload shipping rates.

Consolidation will be by shipment consolidation number. This consolidation number will be indicated on the label of each package in the shipment. The Shipping Department will assign a consolidation location to each shipment. This location will be displayed with shipment consolidation number to facilitate parcel sorting.

Upon completion of consolidation and carrier arrangements, the bill of lading will be completed. The Shipment Consolidation Card will be input through a remote input device with the bill of lading number and carrier code, completing shipment reconciliation.

The shipping procedure described will reduce congestion and delay in the shipping areas by enabling before-the-fact shipment processing. Additionally, as most of the bill of lading data will originate in the processor, the problem of data capture is eliminated. Information originating externally is easily input through a standard data-collection device.

Figure 19: Shipment Consolidation Card



5. EQUIPMENT CHARACTERISTICS

The warehousing procedures that have been proposed include three basic types of input/output equipment. They are the dispatcher inquiry device, receipt storage data recording device and warehouse on-line input device.

The primary factors in the choice of these devices were simplicity of operation and minimization of error possibility.

The following paragraphs contain specifications for these equipments.

5.1 Dispatcher Inquiry Device

5.1.1 Purpose

This device will be used by receiving department personnel to obtain storage locations for incoming material. It will also be used to obtain further shipping data for receipt for transshipment.

5.1.2 Characteristics

Identical to those described for the customer inquiry device described in Section II with the following exceptions:

1. No plate reader is required
2. Date and priority keys are not required
3. Transaction type keys will include
   a. FIIN
   b. Bill of Lading Number
   c. Purchase Order Number
   d. Transshipment

5.1.3 Estimated Price

Approximately $3500.00. On the basis of a 36 month amortization, this is equivalent to a monthly rental of 97 dollars per unit.

5.2 Receipt Storage Data Recording Device (Figure 20)

5.2.1 Purpose

This device will be used in the warehouse for recording storage location and quantity for all incoming material. This data is recorded in an EAM card.

The storage location (5 digits) will be recorded from a coded plate, and the quantity (6 digits) will be recorded from an integral keyboard.

5.2.2 Characteristics

The device shall operate with both metal and plastic plates. Plates will provide a minimum of five digits of data.

Interlocking is required to insure proper insertion of card and plate, which will be ejected automatically after recording.

The keyboard may be stroke or slide type, and will include a minimum of six columns. A means for verifying and clearing variable entry before recording will be provided.

The device will be sufficiently durable for extensive use under manufacturing conditions.

5.2.3 Estimated Price

Approximately $180.00.

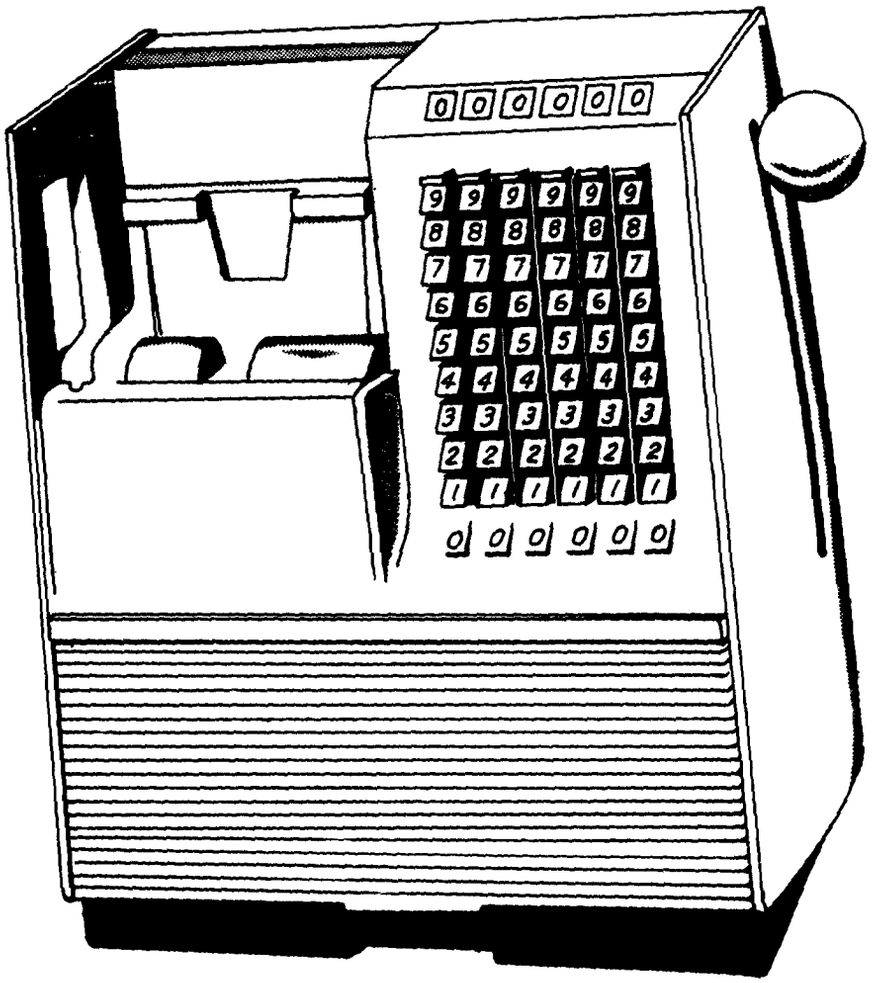


Figure 20: Receipt Storage Data Recording Device

5.3 Warehouse On-Line Reconciliation Input Device (Figure 21)

5.3.1 Purpose

This device will be used in all warehouse areas for reconciliations and data collection.

5.3.2 Characteristics

This device will include a card reader and a means of variable data entry.

Up to 80 digits of fixed data in two cards and 12 digits of variable data will be transmitted in each operation. A simple means for changing input format will be provided.

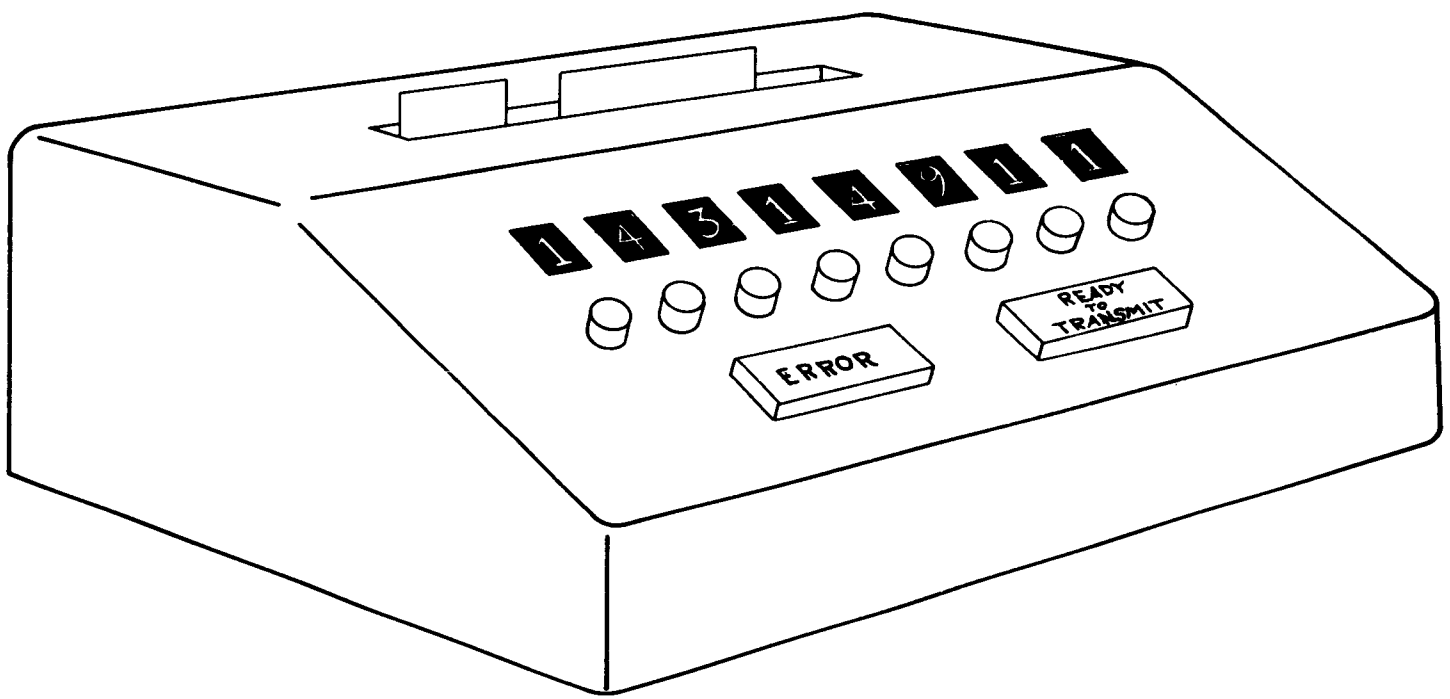
Error checking shall require full message composition before transmission, and interlocking to insure correct card positioning.

The keyboard may be stroke or slide type. Dials will also be acceptable.

5.3.3 Estimated Price

Approximately $1500.00. On the basis of a 36 month amortization, this is equivalent to a monthly rental of approximately 45 dollars per unit.

Figure 21: Warehouse On-Line Reconciliation Input Device



PART IV - CONCLUSIONS

1. CONCLUSIONS

This report describes recommended procedures for the Navy Supply Data Processing System and the functional characteristics for the input/output devices requisite to its implementation. It is felt that these procedures will result in important improvements in both service to users and internal operating efficiency.

The proposed devices are compatible with both a centralized and/or decentralized data-processing system. Present availability of these devices is best described in three categories:

1. Presently available and usable as is;
2. Presently available but requiring integration into the communications system; and
3. Requiring development.

The first category includes the Warehouse Source Data Recording Device (Figure 20) and high-speed card-sorting device referred to in Section II.

Equipment presently available but requiring communications integration include EAM card transceivers, communications printers and data-collection devices for implementing proposed warehouse procedures. These equipments are presently available from several manufacturers of office equipment. Dependent upon the final configuration of the selected communications system, the successful integration of these devices will probably require the development of suitable communications interface equipment.

The third category includes the Message Composer and the Inquiry Device used in the Customer Control Points and the Inquiry Device used by the Warehouse dispatcher. These exact devices do not presently exist. Similar equipments in existence do not meet all of the functional requirements necessary for use in the aforementioned areas. For this reason, it will be necessary to adapt existing devices and/or develop new devices for these operations.